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THE USAF C-17 FLEET:

A STRATEGIC AIRLIFT SHORTFALL?

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Preface

In light of deteriorating defense budgets, funding to develop and procure replacement weapons systems becomes increasingly uncertain. The problem often stems from the lack of alternatives to replace obsolete systems. Sometimes the mission is delegated to other resources: for example, satellites now perform many tasks that the SR-71 used to accomplish. In other cases, where national security strategy dictates, the mission diminishes or disappears altogether: for instance, the end of the Cold War enabled all U.S. military services to significantly reduce nuclear arsenals and their delivery platforms. There are other illustrations where alternatives present themselves to supplant decaying weapons systems, but in the case of the C-141 strategic airlifter this is not so.

The C-17 *is* the appropriate alternative to meet America's future airlift requirements. But we must acquire it in sufficient numbers to meet our needs. Too often we take the inappropriate course on a journey where the way is clear. This is turning out to be true with the C-17. Unfortunately our neglect of facts and blindness in foresight with regard to the strategic airlift force will have a high price for America in years to come. I genuinely hope that reports such as this continue to highlight our need to fiscally budget for a robust airlift fleet that will meet the country's future peacetime and contingency requirements.

Abstract

The United States Air Force requires a core airlifter to accomplish national military objectives. The current aircraft that fills this role, the aging C-141 Starlifter, is being replaced by the C-17 Globemaster III. The success of this new airlifter depends not only on its inherent capabilities, but also on the size of the fleet. Determining the "right" size rests on our ability to forecast future requirements and tailor our airlift assets to meet established objectives.

Current studies and recent contingencies indicate that strategic airlift force structure will be unable to meet our present national security strategy and national military objectives. This report analyzes the ability of our current and future airlift forces to project and sustain U.S. power abroad. To this end, the focus of the research is in three resource planning areas: 1) present and future requirements; 2) current capabilities; and 3) airframe attrition. In the requirements discussion, the analysis highlights the underestimation of airlift needed to deploy and sustain U.S. forces in major regional conflicts around the world. The capabilities section examines airlift to the extent to which current and future fleets meet projected requirements. Finally, the last segment emphasizes the need to account for airframe attrition when using resource planning models.

The findings from this research project indicate that Air Mobility Command, although seriously concerned about deficient core airlift capabilities, will not have the ability to meet future taskings posed by major regional conflicts.

Chapter 1

Strategic Airlift Today

> *I think there is a legitimate concern about where we're going with force structure and modernization, and there is a lot of discussion in that regard …the concern is general, across the board. In the lift business, we are modernizing right now. It's about time, I might say.*[1]
>
> —General Robert L. Rutherford

Introduction and Problem Definition

Worldwide mobility for U.S. military forces is a fundamental precept in our national security strategy of "engagement and enlargement."[2] Core strategic airlift provides the country's uniformed services with crucial mobility, and yet this capability is jeopardized by C-17 shortfalls looming on the horizon. Strategic lift, in the interests of "enhancing our security," is implied within the framework of the current administration's national security strategy document.

> To protect and advance U.S. interests in the face of the dangers and opportunities outlined earlier, the United States must employ robust and flexible military forces that can accomplish a variety of tasks:
>
> *Deterring and defeating aggression in major regional conflicts.* Our forces must be able to help offset the military power of regional states with interests opposed to those of the United States and its allies. To do this, we must be able to credibly deter and defeat aggression by projecting and sustaining U.S. power in more than one region if necessary.[3]

Today, the ability to meet the operational objectives of power projection and force sustainment *from* the continental United States is the heart of the issue. Because of this, air mobility in the post-Cold War global environment is emerging as a crucial element in promoting the U.S. national strategy of engagement and enlargement. "National security strategy depends on decisive air mobility forces to protect America's vital global interests."[4] As our nation moves away from forward overseas basing, we face the rapid mobility demands that a CONUS-based, expeditionary military force presents. To that end, airlift delivers the majority of the initial time-critical forces and war materiel to regional hot spots in support of expeditionary operations. To meet these strategic needs, the United States armed forces rely on a core airlifter to accomplish both peacetime and contingency taskings. Unified commanders and Air Mobility Command (AMC) demand that this airlifter be reliable and operate throughout the range of military environments -- herein lies the problem.

Air Mobility Command's current core airlifter, the C-141B Starlifter, can no longer meet operational requirements and therefore limits the National Command Authority's options in peacetime and contingency scenarios.[5] Although the fleet of C-141s recently went through major repairs, its future viability in strategic airlift is questionable. "Problems such as the weep holes on the lower surface of the wing show the age and deterioration of this well used aircraft. As the aircraft continues to age, it is quite possible new structural problems may limit the readiness of the force…Additionally, the process of retiring high flight hour equivalent aircraft will culminate with the retirement of the entire AMC active duty fleet by FY03."[6] A follow-on airlifter acquired in sufficient numbers to

replace the aging C-141 fleet is therefore vital to implementing national security strategy and meeting U.S. mobility objectives.

Thesis Statement

Procuring only 120 C-17 Globemaster III aircraft to replace the C-141 fleet will not meet U.S. wartime requirements for core strategic airlift. Although the C-17 is now exceeding design expectations, the fleet will not provide enough volume core airlift for the United States in the 21st Century. Fortunately the C-17's ability to meet its strategic airlift specifications, once arguable, is no longer in question. Initially plagued with contractual and design problems, the aircraft is now fully operational at Charleston Air Force Base (AFB), South Carolina. A month-long reliability, maintainability, and availability evaluation (RM&AE) in 1995 tested the aircraft's performance in simulated wartime taskings. The results were exceptional: in 2,252 flying hours and 513 sorties, the C-17 had a 99 percent overall reliability rate and a fully mission capable rate of 84 percent (11.1 percent better than specification).[7] However, even with these encouraging results, the reduced final fleet size of 120 aircraft raises serious speculation about volume lift capability.

Overview

This paper examines the C-17 program in three fundamental areas of airlift planning and operations. The initial focus will explore the airlift requirements for both current and future airlift fleets. Next, in order to meet these requirements, the report shifts toward airlift fleet capabilities with the C-17 as the primary core airlifter. Third, a look at wartime and peacetime operations reveals how lift capability is degraded over the life of the

weapons system. This paper concludes with recommendations for developing a realistic, yet credible, core airlift fleet.

Notes

[1]General Robert L. Rutherford, "Rutherford on Lift," *Air Force Magazine* 78, no.11 (November 1995): 46.

[2]The White House, "A National Security Strategy of Engagement and Enlargement," Washington, DC: U.S. Government Printing Office, 1996, 13.

[3]Ibid.

[4]U.S. Air Force, Air Mobility Command, *Air Mobility Master Plan*. Scott AFB, Ill.: October 1996, 1-30.

[5]Ibid., 1-31.

[6]Ibid., 5-21.

[7]Gudrun R. Fruehling & David Silverberg, "The C-17: From Trouble to Triumph," *Armed Forces Journal* 133, no. 2 (September 1995): 35.

Chapter 2

Strategic Airlift Requirements

> *Historically America hasn't been very successful in maintaining ready, capable forces while reducing its military…This time we need to get it right so we can be ready for the security problems of an increasingly complex world.*[1]
>
> —Dr. William J. Perry

Resource Planning

In an ideal airlift world, requirements are the driving factor behind force capabilities. This being the case, the task for airlift planners is twofold: 1) estimate present capabilities and 2) predict future requirements. In the balance lies the ability to meet our national military objectives. The realized difference between these two endeavors equates to airlift surplus, requirements-capability equilibrium, or airlift shortfall.

Airlift planners use three different types of planning approaches to accomplish national military objectives: resource planning, deliberate planning, and crisis action planning. Within each of these approaches, models are used to gather and process data to yield usable information on strategic airlift operations. For long-range strategic forecasts, resource planning is the most appropriate tool to accomplish our objectives. From here, resource planning focuses on the two areas mentioned above; capabilities and requirements.

Capabilities-based planning and decreasing force structure are realities of today's strategic environment. With the Goldwater-Nichols Defense Reorganization Act of 1986, the end of the Cold War, and this decade's shrinking defense budgets of this decade came a drive toward the Department of Defense's (DOD) capabilities-based planning.[2] Presently, capability assessments determine our airlift force's ability to meet lift demand (known as *force closure*) from a finite pool of resources. From these assessments, capabilities-based plans focus on programmed equipment that is currently available or expected to be available at the end of a specified planning period.[3] Although this is a valid approach to resource planning, strategic airlift *requirements* must also be examined since users within DOD pose demands on airlift resources for mobility needs.

On the "pull" end, requirements studies estimate the assets needed to meet a given force closure. Specific focus on strategic airlift requirement issues is AMC's responsibility, but U.S. Transportation Command's (USTRANSCOM) overseeing part as a unified command plays an integral role in determining needs as well. Requirements studies produce valuable insights by incorporating both historical sources and current data/trends to estimate present and future demands on strategic airlift. Because of their value, resource planning and requirements studies have guided us over the past two decades.

Requirements Studies

Congressional interest in U.S. strategic mobility requirements led to three separate studies on the subject in the last 15 years. These analyses attempted to shed light on possible shortfalls within the airlift, sealift, and prepositioning triad for our national

military strategy—fighting two near-simultaneous major regional conflicts (MRC). In the first study, the Congressionally Mandated Mobility Study (CMMS) of 1982, the JCS estimated airlift requirements to be as high as 150 million-ton-miles/day (MTM/D)—a figure that is three times our current capability. Obviously, a fiscal compromise was reached to limit projected airlift capability to 66 MTM/D.[4] However, even with Air Force transports handling 37 MTM/D and the Civil Reserve Air Fleet (CRAF) moving 15 MTM/D, the remaining 14 MTM/D was a shortfall for which there was no lift available.[5] This tentative, yet alarming estimate, was one impetus for initiating the C-17 program.

A second study, the Revised Intertheater Mobility Study (RIMS) followed the CMMS, focused on a Middle East global war scenario, but it made overly optimistic assumptions with regard to infrastructure and host nation support.[6] Although this analysis revealed shortfalls, DOD didn't approve the results and its impact was minimal.[7]

Finally, the Mobility Requirements Study (MRS) was undertaken by the Director of Force Structure, Resources and Assessment (J-8) Joint Staff in 1992. Its charge was to predict and evaluate mobility requirements for the year 1999 and then produce a roadmap to reach those requirements. Estimates from this study indicated that nearly 60 MTM/D would be required to meet contingency taskings. From this figure, the MRS projected a required force of 109 C-5s, 120 C-17s *and* 230 C-141s.[8] Of significance here is that the ability to reach the 60 MTM/D requires keeping 230 C-141s in service—the only way to achieve parody after losing 90 of the planned 210 C-17s. Still other sources place the requirement near 57 MTM/D, lending more credibility to the MRS figure of 60 MTM/D.[9]

Beyond the MRS, the Mobility Requirements Study Bottom-Up Review Update (MRS/BURU) and a subsequent Army study of its ability to preposition war materiel

established the cargo airlift requirement at 49.7 MTM/D.[10] The 49.7 MTM/D figure and the MRS/BURU are instruments that AMC currently uses to shape strategic airlift forces.

Another tool to figure airlift requirements, in addition to the MTM/D method that AMC uses, is a cumulative cargo requirements projection. This chart projects required tons of war materiel for airlift over a specific timeline. The advantage of this model is that it does not place a specific number on airlift requirements per day—demand for airlift varies based on user requirements throughout a contingency.

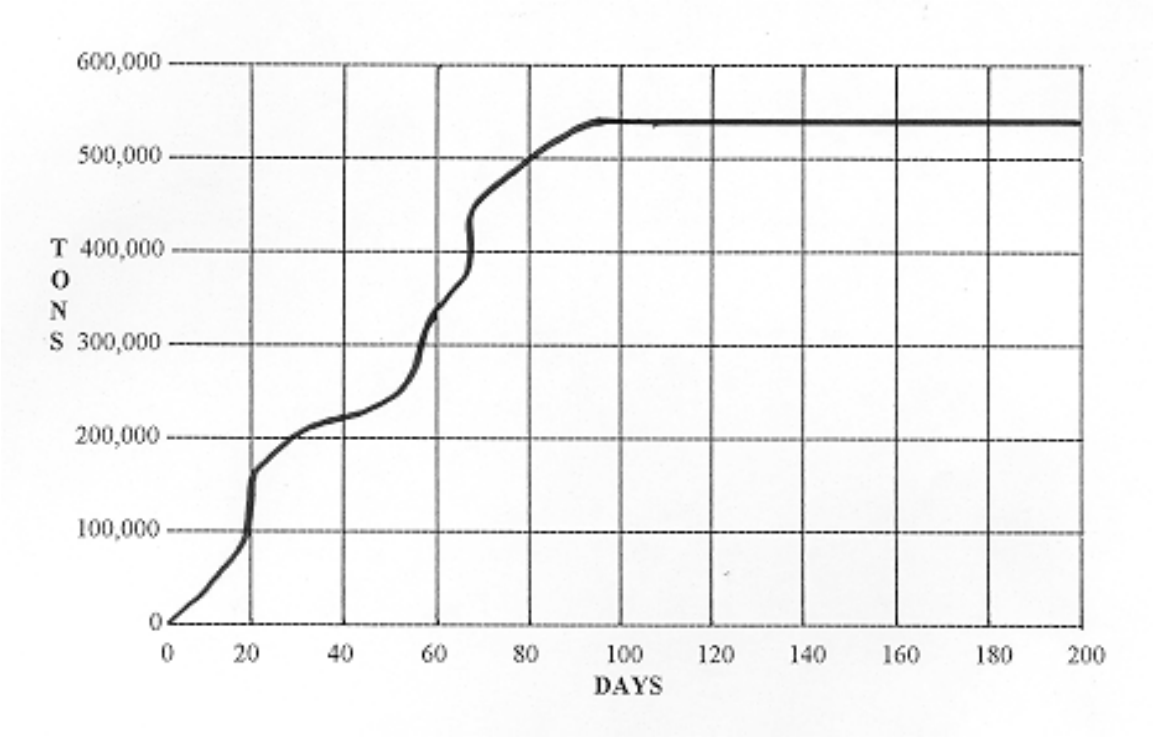

Figure 1. Cumulative Airlift Cargo Requirement

Figure 1 shows the current cargo requirements chart extracted from the 1996 Air Mobility Master Plan (AMMP).[11] Crucial time periods for the flow of supplies present themselves on this graph. The initial buildup (first 14 days) of the cargo requirement plot is shallow because the assets to facilitate airlift operations are being positioned in this phase. Once those assets are in place, lift requirements expand.

From day 15 to day 21, airlift assets are moving combat units into theater, specifically Air Force fighter wings, Marine expeditionary brigades and Army light divisions. These forces will require *all* the U.S. organic military airlift to position themselves within this timeframe—approximately 100,000 tons of cargo in a 7-day period. To put this into perspective from an airframe utilization standpoint, it takes 400 C-5 sorties and 1200 C-141 sorties to move one Army division.[12] Using the airlift planning factors chart (see Table 1) from the Air Mobility Master Plan, we can project the number of sorties this equates to for a future fleet of C-5s and C-17s—400 and 600 sorties, respectively.[13] Given a fleet of 120 C-17s, of which 110 will be in operational squadrons, that is over five roundtrips from CONUS bases to move that division. Keep in mind, that's for one division and does not include moving any other warfighting resources.

Table 1. Airlift Planning Factors

	Utiliz. Rate Surg-hrs/day	Utiliz. Rate Sust-hrs/day	Blockspeed (Knots)	Payload (Short-tons)	MTM/D (Per Acft)
C-5	10.87	8.39	423	65	.1405
C-141	12.1	9.7	410	23	.0536
C-17	15.15	13.9	410	45	.1314
KC-135	10.0	10.0	440	10	.0207
KC-10	12.5	10.0	445	40	.1046
CRAF 747	10.0	10.0	465	78	.1705

Day 50 to day 70 marks another high-demand period for strategic airlift. During this 20-day period, requirements jump by nearly 200,000 tons. Army heavy divisions, more Marine expeditionary forces, and additional Air Force combat squadrons require a bulk of the airlift. It is during both of these peak demand times that our lift capability is severely

strained. This cyclical demand phenomenon will be revisited in how it relates to capability in the next chapter.

Studies currently in progress are the Strategic Airlift Force Mix Analysis (SAFMA) and a Tactical Utility Analysis. The SAFMA readdresses airlift requirements to support two MRCs, and the Tactical Utility Analysis examines the question, "Is there something besides those two MRCs that we need to concern ourselves with?"[14] Although the inclusive timespan from the CMMS to SAFMA, extends beyond 10 years and the contextual elements vary considerably in the post-Cold War environment, there appears to be consistency in identifying high demands for strategic airlift.

Beyond these studies, the Gulf War provides a real world example of our ability to deploy and sustain forces in an MRC. Desert Shield/Desert Storm did indeed test our air mobility assets, but there were factors that masked significant shortfalls within the system. First, Saudi Arabia provided the Coalition with unprecedented host nation support, especially in terms of water and petroleum-oils-lubricants (POL). Second, the modern infrastructure in place within the Kingdom of Saudi Arabia (most notably, airports and seaports) maximized efficiency and minimized turn-around times for airlift and sealift assets. Finally, the protracted deployment time from August 1990 until January 1991 lends itself to obscuring shortfalls within the system, especially in the first 4 weeks when Coalition forces were most vulnerable to attack. During a prolonged deployment operation such as Desert Shield presented, airlift shortfalls are absorbed in follow-on sorties and sealift missions.

The bottom line in the aforementioned studies and the Gulf War is that it is very difficult to develop concrete data on projected requirements for contingency scenarios.

Logistics are substantially affected by the Clausewitzian fog and friction that surrounds war. To counter the effects of unpredictable logistical problems, airlift planners and forecasters must be conservative in their estimates of wartime strategic requirements. With this in mind and given the 49.7 MTM/D established by MRS/BURU as our baseline airlift capability, the current target force structure may be unrealistically low in relation to actual needs—essentially invalidating the C-17 airlift fleet that is being tailored to meet this mathematically generated figure. Unfortunately, until a more conservative requirements analysis supersedes MRS/BURU, the 49.7 MTM/D requisite stands as our objective airlift demand. Chapter 3 will examine this requirement in terms of current and projected capabilities.

Notes

[1]William J. Perry, "The Rules of Engagement," *Defense Issues* 9, no. 84 (3 November 1994): 1.

[2]Joint Chiefs of Staff. *User's Guide for Joint Operation Planning.* Washington, DC: U.S. Government Printing Office, 1994, 4.

[3]Ibid.

[4]Richard W. Kokko, "Strategic Mobility for the National Military Strategy," Air War College, Maxwell AFB, Ala., April 1993, 16.

[5]Kent N. Gourdin, "Contingency Transportation and the C-17: Meeting America's Needs in a New Era," *Defense Transportation Journal* 50, no.5 (September/October 1994): 59.

[6]Kokko, 16-17.

[7]Andrew E. Gibson and Jacob L. Shuford, "Desert Shield and Strategic Sealift," *Naval War College Review*, Winter 1991, 9.

[8]Raymond R. Drummond, "Airlift: The Strategic Achilles Heel of The United States," Army War College, Carlisle Barracks, Penn., April 1993, 3.

[9]John Boatman, "C-17 Shortfall Threatens to Widen Looming U.S. Airlift Gap," *Jane's Defence Weekly* 21, no. 20 (21 May 1994): 18.

[10]U.S. Air Force, Air Mobility Command. *Air Mobility Master Plan.* Scott AFB, Ill.: October 1996, 1-26 - 1-27.

[11]Ibid,1-27

[12]David C. Rauhecker, "The Critical Impact of Strategic Mobility on National Security," The Industrial College of the Armed Forces, Fort McNair, Washington, DC, 1992, 14.

Notes

[13]U.S. Air Force, 1-25.

[14]Robert L. Rutherford, "Rutherford on Lift," *Air Force Magazine* 78, no.11 (November 1995): 46.

Chapter 3

Strategic Airlift Capabilities

> *Reluctance to pay the cost of defense and the American propensity to discount the need for a sizable standing military establishment during periods of peace invariably have led to being unprepared to face the next crisis.*[1]
>
> —General Gordon R. Sullivan

Force Restructuring

America's strategic airlift capability today is in a state of transition due to shifting internal and external factors. Internal changes since the end of the Cold War have driven the USAF and AMC to reshape the way strategic airlift business is done. In June 1990, Military Airlift Command (MAC) was restructured and subsequently renamed Air Mobility Command. A very fundamental concern within the new command was the accelerated aging of the airlift fleet. Numerous real world operations, in addition to recent Desert Shield/Desert Storm taskings, were draining years of airframe life from the fleet—specifically, the C-141s. Many of these sixties era aircraft were reaching their 35,000-hour service life and being refurbished to fly for an additional 10,000 hours. However, some of the more stressed aircraft were beyond saving and had to be retired. This attrition of AMC's core airlifter was in one respect compensated for by another aspect of the command's restructuring—the addition of tanker assets.

Within the command reorganization, AMC gained two strategic airlift assets from the disbanded Strategic Air Command—the KC-10 and the KC-135. The newly formed Air Mobility Command and Air Combat Command divided the KC-10 and KC-135 assets. The principle reason for providing AMC with organic refueling capability was to put "global reach" into its mission statement. No longer would strategic airlift have to go beyond its own organization to find tankers. Figure 2 depicts the current and projected AMC tanker forces.[2]

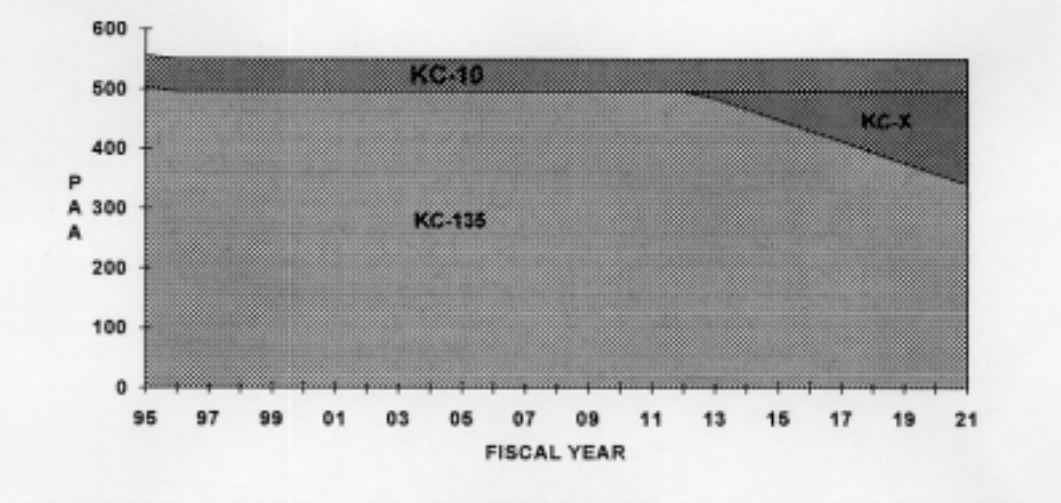

Figure 2. Tanker Force Structure

A windfall for AMC from the addition of KC-10 and KC-135 assets was their untapped cargo carrying capability. At a time when core airlift resources were strained, these dual role aircraft provided a shock absorber for the air mobility system. By combining these weapons systems with the C-5 and C-141 force, airlift capacity increased by just over 6 MTM/D.[3] Most of that additional haul ability came from the KC-10 (approximately 5 MTM/D), but the KC-135 did and continues to fly many of AMC's worldwide, low-volume cargo missions. The importance of this added capability from both aircraft, although relatively small, cannot be overstated. The KC-10s and KC-135s,

by absorbing some of AMC's scheduled missions, now allow the C-5s, C-17s, and C-141s to accomplish the tasks that are unique to their capabilities.

In this time of transition, and beyond, the tanker force will carry on this secondary role of strategic airlift. Given its short track record in airlift, it is essential that we continue to look for efficient ways to incorporate it into logistical operations. Additionally, as Figure 2 shows the KC-135 beginning to reach its service life in 2012, AMC must view its replacement not only from an air refueling perspective but from an airlift perspective as well. The KC-X will undoubtedly be more of a hybrid like the KC-10, and it may also have many of the C-17's capabilities. Some configurations may even allow the C-17 to operate in this role, thereby realizing the strongest traits of both tanker and airlifter. Although the addition of tankers to supplement the strategic airlift force is an important consideration, a new core airlifter was still required to fulfill both volume and mission-specific requirements.

Core Airlift

Successful U.S. power projection lies in our ability to field a modern strategic airlift fleet, sufficient in both numbers and capability. This fleet must have adequate capacity, range, and versatility to meet the broad spectrum of military requirements. Per the Air Mobility Master Plan, Figure 3 depicts current and projected U.S. strategic airlift forces. Here, the 109 operational C-5s are a given in the equation as their service life carries the weapons system well into the next century.[4] The problematic variable thus becomes the C-141 as it retires, followed up by the C-17 to replace it. How do we meet the requirements driven by a near-simultaneous two MRC scenario? What final production

numbers are we looking at for the C-17, and what should the force mix be until all those new aircraft are operational? This is where requirements and capabilities meet the road, and tabulating the numbers takes the best airlift planners to decide an appropriate mix for meeting our national military objectives.

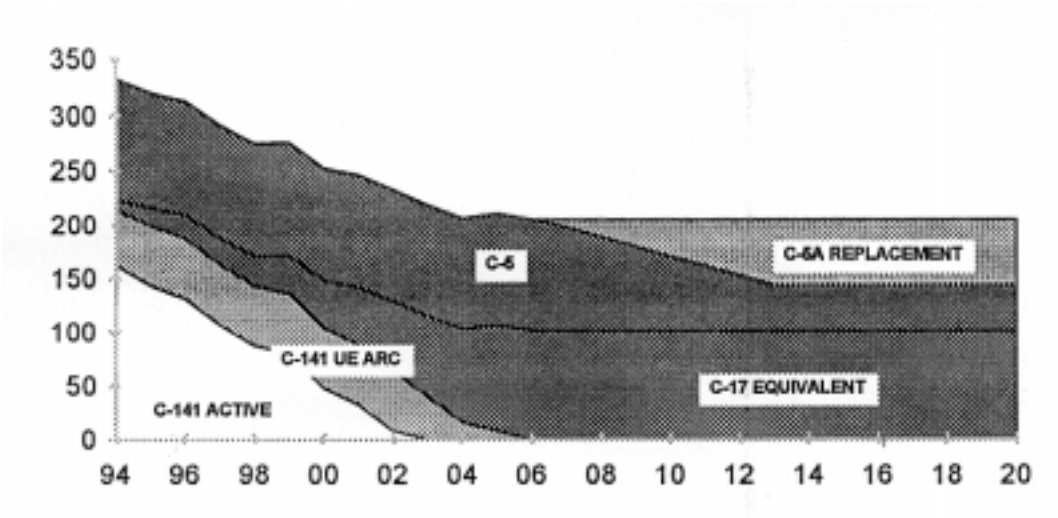

Figure 3. Strategic Airlift Force Structure

The problem Air Mobility Command planners face is not with the capability of the new core airlifter, but instead with the relatively small number of operational C-17s that will replace the C-141s. Currently 242 C-141s provide the core capability for AMC's strategic airlift fleet.[5] In the late 1980s, initial plans for operational C-17s called for 210 aircraft to be completed by 1998 to replace the C-141 fleet.[6] However, because of research, development and production impediments with the McDonnell Douglas Corporation, the C-17 primary contractor, the Air Force had to reevaluate the program. The eventual setbacks gained the attention of the House of Representatives Subcommittee on Military Acquisition in 1993 and in turn led to program hearings on the C-17. In his testimony to the subcommittee panel Col Kenneth Tollefson, Commander of the Plant Representative Office, believed the development and production problems were rooted

within Douglas management. "Since Douglas has chosen to inadequately budget the contract, cost and schedule have constantly grown and will continue to do so. Furthermore, cost problems should be expected to increase at a greater rate. Postponed work becomes more expensive and takes longer. The rule of thumb is that the impact is exponential rather than linear."[7] Further examination in the same hearings from the General Accounting Office (GAO) conversely indicated that the problem was two-sided in the developmental and production process. Both the Air Force's and Douglas' official cost and schedule estimates were consistently optimistic based on declining cost performance trends, test problems, and slips to the test flight schedule.[8] Unfortunately, because of these undefinitized contract agreements, confining aircraft specifications, and production delays, Congress and the USAF did not fund the needed 210 airframes due to resulting cost overruns and shrinking defense budgets.

Airlift Dilemma

The resulting contract for 120 C-17s to replace the C-141 fleet is slightly more than half the original 210-aircraft requirement deemed necessary to meet both present and future strategic lift requirements. "In the Pentagon's 1992 Mobility Requirements Study, when the plan was to still have 120 C-17s in the FY99 fleet, the USAF identified a 'moderate risk' in its ability to deliver combat units as required to the first major regional conflict, running about two weeks behind by day 30."[9] A less optimistic, but perhaps more accurate term for "moderate risk" is shortfall. Beyond that, the study also forecasted that there would be a significant decline, about 5 MTM/D, in total airlift capacity as the C-141s retire. In order to retain that airlift capability, the study

recommended that the DOD needed to extend the C-17 program by 34 aircraft or find a suitable airlift alternative.[10] AMC's move to employ KC-10s, KC-135s and contract carriers as a stopgap measure to reverse the declining core capacity means U.S. strategic airlift capability will suffer and be unable to meet future contingency requirements.

Figure 4 illustrates the strategic airlift dilemma that planners face in an MRC Time-Phased Force Deployment Data (TPFDD).[11] Beyond the 49.7 MTM/D claim discussed earlier, this figure compares airlift capability with requirements. Closure in this illustration is the cumulative daily tons-delivered to theater. More simply, this represents the tons deemed essential by the TPFDD in relation to the capability available from present and predicted airlift fleets. The gap between the TPFDD needs and capability is strategic airlift shortfall. Cumulative shortfall is only part of the problem, however.

Our inability to meet peak demands along the deployment timeline presents a significant deficiency in moving volume at crucial times in the contingency. The capability lines ("Today's" and "Future" fleets) are linear because these represent a fixed number of airframes operating at wartime surge rates. In other words, that is all our assets giving as much as they can give. These airlift resources are able to move approximately 60,000 tons every 20 days throughout a contingency. However, the peak demands at 15-21 days and 60-70 days find both our current and future fleets woefully short in lift capability.

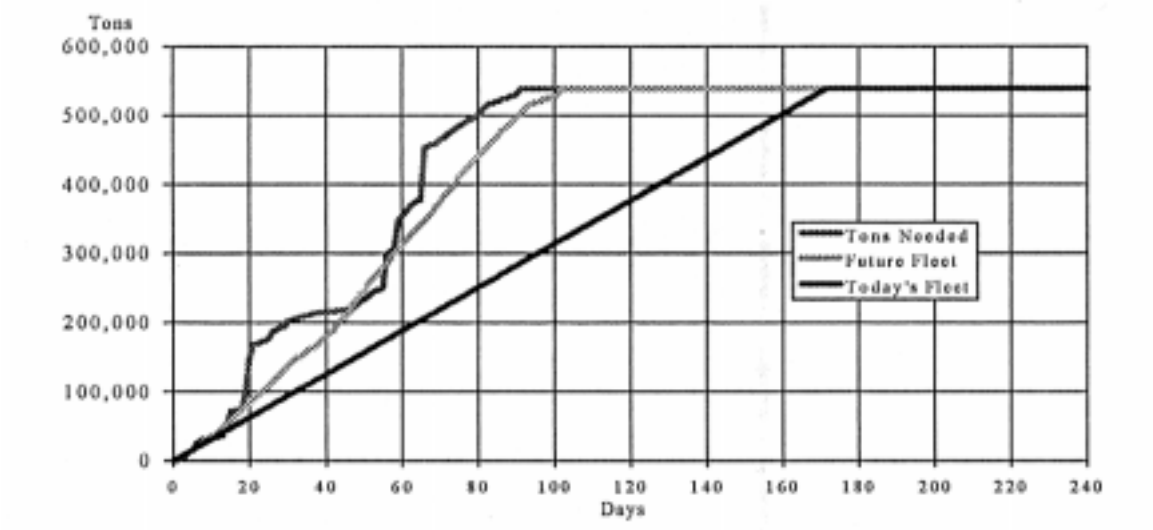

Figure 4. Cargo Closure Requirement versus Capability

Further analysis of this graph shows the inability of current airlift to provide cumulative tons required by theater commanders until the 170-day point of the timeline. Additionally, although our projected fleet fairs better, capability still shows a lag in tons delivered until the 100-day point. This can be attributed to playing "catch-up" from the peak demand periods. Although our capability to meet demand during non-peak times is adequate, the overall capability to meet requirements is lacking. To make the ramifications of this graph clear in a hypothetical sense, Desert Storm provides an interesting example.

The Gulf War: A Case Study

The airlift of war materiel to the Persian Gulf was the largest of its kind in history, and as indicated earlier, it provides some valuable lessons. From the start of Desert Shield to the beginning of the air war, the Coalition had over 160 days to accomplish this unprecedented logistical feat. From Figure 4 we see that 160 days closely coincides with our ability to airlift required supplies to theater. Given a future fleet with greater

capability, we would have met the TPFDD line by the 100-day point; the end of November 1990 in Desert Shield. But for the sake of this example, what would have happened if the Iraqis initiated the war on day 20 of the timeline? One-hundred and forty days would have elapsed before airlift caught up with theater commanders' combat requirements. Looking at the diverging capability versus requirement lines from day 20 through day 100, there are instances along the timeline where the shortfall exceeded 200,000 *tons.* Putting it into perspective, that is equivalent to 2,800 M1A1 battle tanks (more than the Army has in the entire inventory), or 200,000 two-thousand-pound bombs, or a *whole* bunch of "beans and bullets" for combat forces still sitting in CONUS bases waiting for airlift. This leads to the question, "What are the implications of the nation's inability to meet these wartime airlift requirements?"

Two clear notions come to mind when logistical supply does not meet the warfighter's demand in contingency operations. The most obvious is that American forces will suffer losses while *waiting* for the equipment and supplies they need to fight with. This is especially crucial early on in war where light forces may be the only ones in place to halt an attack—very typical of what we saw in the Gulf and what our expeditionary military will be faced with in the future. Next, and just as important, is that the war may be over before we arrive in theater ready to fight. If we turn the table in the Gulf conflict and imagine the Iraqis continuing to prosecute the war across Saudi Arabia immediately after conquering Kuwait, our airlift capability might not have caught up with demand until well after the Coalition was defeated. Clearly airlift provides the crucial, rapid response we require to position forces to fight. For each MTM/D we shortfall and for every day we

cannot meet the TPFDD timeline, we place our people and the successful outcome of the contingency at risk—sobering thoughts for a force-in-waiting.

For argument's sake, we leave this chapter with one final supposition. Given that our strategic lift forces were fully mobilized in Desert Shield's buildup and that the Persian Gulf presented merely a single MRC scenario, what if North Korea had made the most of this opportunity and invaded South Korea in the fall of 1990? Could the strategic assets have handled the two MRC requirement? Doubtful. General William C. Moore summed up our capabilities best when he said, "Our organic resources and Civil Reserve Air Fleet produce a lot of lift capability. But, continuing studies show that even with all our military transports and the CRAF, we still don't have enough capability to meet a war in Europe."[12] Given the evidence, we could safely add *any* theater to the list.

Notes

[1]General Gordon R. Sullivan, "America's Force for Today - and Tomorrow," *Defense Issues* 9, no. 79 (29 September 1994): 6.

[2]U.S. Air Force, Air Mobility Command. *Air Mobility Master Plan.* Scott AFB, Ill.: October 1996, 5-16

[3]Ibid., 1-25.

[4]Ibid., 5-15.

[5]Robert Ropelewski, "Western Allies Mull Airlifter Requirements," *Interavia* 49, no. 585 (December 1994): 38.

[6]Kent N. Gourdin, "Contingency Transportation and the C-17: Meeting America's Airlift Needs in a New Era," *Defense Transportation Journal* 50, no.5 (September/October 1994): 59.

[7]U.S. Congress. House. Military Acquisition Subcommittee, Armed Services Committee. *C-17 Aircraft Program Review.* Washington, DC: U.S. Government Printing Office, 1993, 7.

[8]Ibid., 53.

[9]John Boatman, "C-17 Shortfall Threatens to Widen Looming U.S. Airlift Gap," *Jane's Defence* Weekly 21, no. 20 (21 May 1994): 18.

[10]Joint Chiefs of Staff. *Mobility Requirements Study(U)* Washington, DC: U.S. Government Printing Office, 1992, VIII-4.

[11]U.S. Air Force, 1-27

Notes

[12]Association of the United States Army, “Strategic Mobility: Can We Get There From Here - In Time?” Special Report, Undated, 4.

Chapter 4

Attrition

> *Until recently, protecting airlifters from ground-based anti-aircraft threats was strictly a matter of tactics. With the proliferation of hand-held infrared-guided surface-to-air missiles and the wide availability of radar-directed anti-aircraft artillery and SAMs, our need for airlift defensive systems has expanded.*[1]
>
> —General Ronald R. Fogelman

Unrealistic Modeling

Deploying and sustaining U.S. forces to a major regional conflict is a difficult proposition in the best of circumstances. Our ability to accomplish this mission in demanding conditions during the Gulf War put a severe strain on all of our airlift resources. In light of the extreme environments in which our aircraft and aircrews operated, Military Airlift Command was fortunate to lose only *one* strategic airlifter—a C-5 that crashed after takeoff at Ramstein Airbase, Germany. For contingency operations, Desert Shield/Desert Storm appears to be an anomaly that could lull planners into a false sense of infallibility. Peacetime and wartime attrition of strategic airlift assets is a reality that incrementally degrades our overall ability to project and sustain U.S. presence abroad. As such, it presents a seemingly overlooked "friction" force that must be factored into future scenarios. This chapter focuses attention on this aspect of air mobility and how it could affect power projection and force sustainability.

Current mobility models that airlift forecasters use for contingency planning do not account for aircraft and aircrew attrition. A recent RAND Corporation study, *A Review of Strategic Mobility Models and Analysis*, highlights fidelity problems with current resource planning models used by the Joint Staff, U.S. Transportation Command, and Air Mobility Command.

> A shortcoming we perceive with current models is that they all assume everything is known with certainty, though of course wartime will be characterized by numerous uncertainties. During wartime, analysts cannot be sure of the quantities of equipment and personnel that units actually possess, the availability and performance of transportation assets, or the availability and capability of airfields and ports. Also, enemy actions or political situations may give rise to events that are unanticipated during peacetime planning. A theater commander's plans and tactics may therefore change, resulting in changes to deployment plans.[2]

The concern this finding generates is clear, and at the same time alarming, when discussing contingency airlift. The Air Mobility Master Plan indicates that the core airlifter must be "survivable in a low threat environment on a routine basis."[3] However, transport aircraft are very vulnerable to attack due to their size, maneuverability and lack of self-protective offensive and defensive equipment. Operating in low threat environments on a "routine basis," regardless of countermeasures, increases the risk of attrition. To that end, beyond developing tactics for threat avoidance and degradation, little has been done to increase the survivability of airlift assets. Initial efforts with the Snow Storm program to retrofit three C-141s and two C-5s with IR defensive capability could hardly be called a comprehensive solution.[4] A similar band-aid approach is underway for the C-17. Currently, only 5 of the 33 operational C-17s have missile warning systems and associated automatic flare dispensers.[5]

As airlift assets are being used more frequently in military operations other than war (MOOTW), their exposure to low and even medium threat environments continues to grow. The recent civil war in Bosnia-Herzegovina provides an immediate example of airlift assets operating at substantially increased risk. C-130 and C-141 aircraft flying into Sarajevo routinely received battle damage from ground fire despite tactical measures to counter the surface threat. The proliferation of advanced shoulder-fired SAMs the world over poses the deadliest threat to our airlift force. Although they were not encountered in Bosnia, their numbers and concealment preclude finding and destroying them in any limited conflict. Consequently, glossed-over fixes to this bona fide airlift problem are unproven and may have minimal impact in preventing future attrition in MOOTW environments.

An even greater risk to the strategic airlift force, specifically the C-17, is present in unlimited war. However, loss estimates for these scenarios are speculative at best. The Rand study did not venture to say how to reach approximate values, only that they should be figured into strategic airlift models.[6] Indeed one estimate found that up to one-third of our strategic aircraft may be lost during the first 180 days of combat.[7] The point is not so much the number itself, but rather the idea that we cannot ignore that losses will occur. If we plan to use the C-17 in combat, then we must factor in attrition. Former CINC/TRANSCOM General Robert L. Rutherford reinforced the aircraft's susceptibility when he said, "We will use the C-17 in a combat situation if we are required to…I'm not going to say that that's its primary role, but it's one more thing that we've got the capability to do."[8]

The shortfield capabilities that the C-17 brings to the table will allow it to operate into forward bases, much like the C-130. With that added capability comes added risk. If the aircraft is to be used near the forward edge of the battle area (FEBA), then the C-130 attrition rate during the Vietnam War would provide an indicator for tactical operation losses. Between 1965 and 1972 the USAF lost 52 C-130s in Vietnam.[9] This equates to an attrition rate of approximately 10.4 aircraft destroyed for every 100,000 hours of flying time.[10] Additionally, at nearly three times the size of a C-130, the C-17 unfortunately provides a considerably larger target for enemy forces. The surface threat becomes significant when operating in the tactical environment, and the C-17 could be right in the thick of it.

"Robust Solutions"

Even if strategic assets are not operating in high or medium threat areas, they will still suffer attrition. The RAND study reveals a planning guide to focus our attention in this area: "We believe that mobility models should produce robust solutions, or at least help the analyst to understand the range of scenarios and assumptions for which a solution 'works.' What must be avoided are transportation force structures that are optimal for only one or a few wartime scenarios and sets of events, but fall apart quickly if actual events deviate from that narrow set of events."[11] One clear way to obtain "robust solutions" is to have depth in assets—more airlift. The second way to enhance your options is to have greater capabilities within the assets that you do have—versatile airlift. The C-17 already does this with its increased payload, longer range, enhanced performance, and advanced technology over the older C-141. It is the number of assets

that presents the problem. Although we attribute attrition mainly to wartime operations, peacetime losses degrade airlift capability just the same.

The C-17 is a new aircraft with a 30,000-hour service life expectancy.[12] Its predecessor took 20 years to reach that figure. In 20 years there will not be 120 C-17s left in the fleet. Peacetime mishaps are a fact of life that will claim a portion of those aircraft. Although we will not establish an accurate mishap rate on the C-17 for several years, we can project an approximate accident frequency based on C-5 and C-141 track records. These aircraft are technologically different, but the missions are essentially the same. And although we would like to be optimistic and say we will not lose any crews or C-17s in the next 20 years, that is simply not realistic. By doing so, we place ourselves in greater peril for a future contingency with too few assets to accomplish the mission. Long-range airlift planners must settle on some number less than 120 aircraft when forecasting scenarios 5, 10, or 20 years from now. Being overly optimistic now means that a fighter squadron in the future will not be moved, or a full brigade of paratroopers cannot be airdropped in a war yet to be fought. We train to preclude accidents from claiming lives and resources, but a year has not yet gone by without military aviation mishaps.

Our best resource planning efforts in terms of requirements and capabilities are in vain if we do not account for aircraft attrition. The United States military has quite often been able to improvise when plans missed the mark or were just plain inadequate. But in a vastly downsized force, that luxury could very well be the exception. Today's airlift planners need to think pessimistically to develop models that introduce less-than-ideal conditions. After all, that is what war usually presents to us.

Notes

[1]Ronald R. Fogelman, "DOD's Global Transportation System," *Defense Issues* 9, no. 40 (20 May 1994): 8.

[2]John Schank et. al., *A Review of Strategic Mobility Models and Analysis.* Rand National Defense Research Institute, 1991, 45.

[3]U.S. Air Force, Air Mobility Command. *Air Mobility Master Plan.* Scott AFB, Ill.: October 1996, 1-30.

[4]Ronald R. Fogelman, "DOD's Global Transportation System," *Defense Issues* 9, no. 40 (20 May 1994): 9.

[5]Paul Jackson et. al., *Jane's All the World's Aircraft 1995-96*, (London: Butler and Tanner Ltd, 1995), 588.

[6]Schank et al., 46.

[7]Ted A. Cimral, "Transportation Emergency Preparedness: Are We Ready?" *Defense Transportation Journal*, September 1980.

[8]Robert L. Rutherford, "Rutherford on Lift," *Air Force Magazine* 78, no.11 (November 1995): 47.

[9]Ray L. Bowers, *The United States Air Force in Southeast Asia: Tactical Airlift*, (Washington DC: U.S. Government Printing Office, 1982), 689.

[10]Ibid., 678-680, 689.

[11]Schank et al., 46.

[12]U.S. Air Force, 5-27.

Chapter 5

Conclusions and Recommendations

Requirements

The requirements estimation from MRS/BURU that Air Mobility Command uses to plan both present and future airlift fleets is optimistically low. CMMS, RIMS, and the 1992 MRS show that the 49.7 MTM/D baseline strategic requirement established by MRS/BURU is approximately 10 MTM/D below actual demand in contingency scenarios. This 20% discrepancy lays the foundation for tailoring a C-17 force to meet an artificially depressed requirement. The end result is obvious: even with all the aircraft from an MRS/BURU-based force in operation, the services face an unprogrammed airlift shortfall of nearly 10 MTM/D.

Beyond these MTM/D estimates that indicate a shortage of strategic lift, time-phased force deployment data also shows that our requirements supersede current and future capabilities. The need to meet timeline requirements *and* handle peak demands within deployment and sustainment operations is clearly a problem to theater commanders. Neither core airlift nor shock absorbing measures will alleviate the problems posed by the time-phased deployment. A likely alternative to minimize airlift requirements and peak

demand is to reduce overall airlift deployment/sustainment operations through the use of fast sealift or prepositioning.

With the final analysis from SAFMA and the Tactical Unit Analysis in process, AMC must adjust the Air Mobility Master Plan to reflect these new studies. In all likelihood, these assessments will reveal increased requirements for future strategic airlift. Additionally, the military services quadrennial review in 1997 will probably impact overseas drawdown in an adverse manner, thereby increasing airlift deployment requirements of CONUS-based forces. The Air Force and AMC must be ready for these events and continue to address strategic lift requirements as contextual elements evolve in the post-Cold War environment.

Capabilities

U.S. strategic airlift forces are modernizing to meet the challenges of today and tomorrow. The C-17 is the crucial link from old to new technologies and capabilities. Despite initial growing pains with the aircraft, it is now performing up to and exceeding many specifications. The problem, however, lies in the final production number needed to meet national military requirements. With DOD production capped at 120 C-17s, recent mobility studies indicate that this will fall short in reaching our strategic airlift objectives. The problem when examining this final production number is not merely the number itself, but how it was arrived at. A final C-17 fleet size of 120 is not requirement-based. Instead, it focuses more predominantly on fiscal budgets than actual contingency need. Military leadership knows this, but unfortunately the civilian leadership that determines fiscal budgets is willing to assume the risk of degraded capability. This raises the question

that many senior military leaders have posed recently, "What good are forces if we don't have the lift to get them there?"

Two solutions present themselves as we assume a "capabilities-based" force structure. First, as this force evolves within fiscally-constrained defense budgets, matching requirements with fixed capabilities demands reducing military taskings presented by an over-extended national security strategy. The current administration's statement that "We must be able to credibly deter and defeat aggression by *projecting* and *sustaining* U.S. power in more than one region," is an invalid one with the shortfall in strategic airlift that 120 C-17s presents.[1] The budget decision to build only 120 C-17s is inconsistent with our national security strategy and should be changed to establish policy congruence. This could very well mean abandoning the two near-simultaneous MRC scenario in favor of a less ambitious national security strategy. On the other hand, if we want to keep capabilities in line with strategy then the Mobility Requirements Study recommends the purchase of at least 34 more C-17s to bolster capability.[2] Although this is fiscally more precarious, it is operationally sound regarding current national policy.

The second option that shows promise from a capabilities standpoint is the move toward multilateral efforts in dealing with the spectrum of security threats. Although this should not absolve us of maintaining unilateral capability, it does enhance our collective capability without putting fiscal burdens exclusively on our shoulders. Both of these approaches could go a long way toward reducing U.S. organic lift requirements (by reducing overall military requirements) and bringing them more in line with strategic capabilities. Paramount to credibility and deterring threats in the international community

is making our "bark consistent with our bite" when it comes to policy and strategic capabilities.

Attrition

Current strategic airlift models do not account for aircraft attrition. Given the hostile environments the C-17 will be operating in, this fact invalidates these models. Therefore, attrition cannot be ignored if we are to reasonably predict future capability versus demand. Presently, there are no clear ways to predict wartime losses beyond studying historical attrition rates of transport aircraft. Even these may not provide applicable data given the proliferation of lethal shoulder-fired surface-to-air missiles in recent years. Likewise in peacetime, aircraft attrition due to operational and training mishaps will degrade the C-17 fleet. These contingency and peacetime losses are especially significant in a downsized force.

As the strategic airlift force downsizes, each individual asset's value within the force multiplies. The age old question of "large fleet size of moderately capable aircraft (C-141s) versus a smaller fleet size of very highly capable aircraft (C-17)" bears consideration. For example, losing one aircraft from a total of 120 C-17s is four times as debilitating to the force as losing one C-141 from a fleet of 242 aircraft—with the C-17's capability twice that of the C-141. The resulting dilemma thus becomes one of utilizing the C-17 to fulfill a mission and risk losing it *or* not using it to conserve the asset and thereby not satisfying mission requirements. The bottom line is that there should not have to be compromise. Curtailing the C-17 fleet that provides core airlift capability for the nation infringes upon a basic tenet of aerospace power—flexibility. Given our recent

history and an uncertain future, a robust core capability is paramount to provide the country with flexible strategic airlift when and where it is needed -- an endeavor in which there can be no compromise.

Notes

[1]The White House, "A National Security Strategy of Engagement and Enlargement," Washington, DC: U.S. Government Printing Office, 1996, 13.

[2]Joint Chiefs of Staff. *Mobility Requirements Study(U)* Washington, DC: U.S. Government Printing Office, 1992, VIII-4.

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